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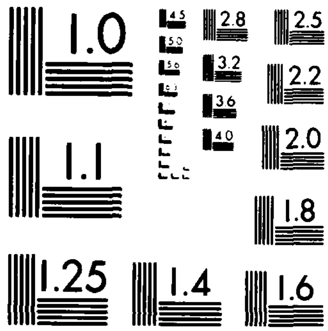

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PRELIMINARY RESULTS OF THE OCEANOGRAPHIC CRUISE
OF USCGC NORTHWIND TO THE GREENLAND SEA
August - September 1984

by

Robert H. Bourke

December 1984

Interim Report for Period 1 August - 31 December 1984

Approved for public release; distribution unlimited.

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This report describes the preliminary results of the cruise of the Coast Guard icebreaker NORTHWIND to the East Greenland Current during August - September 1984. 333 CTD stations were made mostly over the east Greenland continental shelf. 17 crossings of the East Greenland Polar Front were made as was a crossing of the Molloy Deep eddy. The West Spitzbergen Current was noted to turn westward predominantly north of 78°N.

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PRELIMINARY RESULTS OF THE OCEANOGRAPHIC CRUISE OF USCGC NORTHWIND TO THE GREENLAND SEA AUGUST-SEPTEMBER 1984

by

Robert H. Bourke

I. INTRODUCTION

This interim report describes the cruise of the Coast Guard ice breaker NORTHWIND (WAGB-282) to the continental shelf area of the Greenland Sea during August and September 1984. This cruise has been designated Arctic East 1984 (AE84), but for continuity with past cruises is also termed MIZLANT 84. The cruise had two primary objectives: (a) to map the bathymetry of the shelf between 76° and 82°N, and (b) to conduct CTD soundings in these waters to establish the circulation and water mass structure over the troughs and shoals of the shelf. Because of very light ice conditions, both of these objectives were completely met. The NORTHWIND track covered over 6500 km (3500 miles) providing continuous depth soundings over the entire track. Over 300 CTD stations were made while on the shelf, most conducted at 10-15 km intervals in the high interest areas of the troughs, coastal region and other areas of rapidly changing bottom depth.

The scientific party boarded NORTHWIND between 17 and 19 August 1984 in Reykiavik, Iceland. The members of the scientific party and their affiliations are:

Dr. Robert H. Bourke, Naval Postgraduate School, Chief Scientist
Dr. John L. Newton, Polar Research Laboratory
Mr. Robert K. Perry, Planning Systems, Inc., Chief Bathymetrist
Mr. Kim O. McCoy, Private Consultant to NPS
LCDR Mark D. Tunnicliffe, CAF, Student NPS
Mr. George E. Betts, Student NPS.

Prior to boarding NORTHWIND, Drs. Bourke and Newton visited Dr. Peter Wadhams on 17 August at the Scott Polar Research Institute of the University of Cambridge, England. The

purpose of the visit was to learn of oceanographic conditions along the ice edge and the East Greenland Polar Front (EGPF) as delineated in June and July by the MIZEX participants. We discussed the characteristics of the "Molloy Deep" gyre or eddy which was observed and sampled several times throughout the summer during MIZEX. Dr. Wadhams provided us with a photo of the area as observed by the NOAA-7 satellite visual band on 27 August 1984. As seen in Figure 1, this shows only a moderate ice concentration near the shelf break and almost no ice over most of the shelf. This lack of ice, at most 7-8 tenths in patches but more generally 2-3 tenths, was confirmed once NORTHWIND arrived on the shelf; it was singularly responsible for the large amount of bathymetric and CTD data gathered.

The cruise track and location of CTD stations are indicated in Figure 2. A listing of the location of all CTD stations and the water depth at each station is shown in Table 1. The atmospheric pressure, air temperature, and wind speed and direction measured every 6 hours are shown in Figures 3, 4, and 5. The pulse-like nature of the pressure curve reflects periods of bright, sunny weather (periods of high pressure) and cloudy, drizzley day (low pressure). No major storms passed through the area during the cruise. The depressions in the pressure pattern are due to storms which passed far to the south. Throughout the cruise the air temperature hovered about the freezing point, generally remaining within the ±3°C band. The correlation with atmospheric pressure is weak. Wind speeds were generally low, mostly in the 5 to 10 knot range. Periods of wind speeds in excess of 10 knots were generally limited to less than a day except for the period 3 to 4 September when wind speed remained consistently above 15 knots.

II. INSTRUMENTATION

The primary oceanographic instrument was the Neil Brown Instrument Systems (NBIS) Mark III CTD. Data were collected, stored, and displayed using a Hewlett-Packard 9835A computer and 9872A x-y flat-bed plotter. Early in the cruise the plotter

failed. All subsequent graphical outputs were done on the back-up plotter, a Hewlett-Packard 9225B. As in the past, a wire cage was constructed around the base on the CTD to protect the sensors from damage due to ice. No apparent deviation in sensor accuracy has been noted using this technique.

The temperature and conductivity sensors of the NBIS CTD were calibrated at NPS prior to the cruise. A calibrated 3200 decibar pressure sensor was also installed at NPS in order to make deep casts to better establish the baroclinic circulation and transport. Although much of the cruise was conducted in shallow water (<300 m), the vertical resolution of the sensor was more than adequate to resolve all finestructure features of interest. A post-cruise calibration was conducted to establish if any drift occurred. The comparison between pre- and post-cruise conductivity calibrations was inconclusive. An error in either or both calibration curves is likely to have occurred. However, a comparison between salinities measured at two nearby stations, one taken at the beginning of the cruise, the other near the end of the cruise, shows no drift greater than 0.001 ppt occurred. No bottle salinities are available for calibration due to mechanical failure of the laboratory salinometer.

A light-weight, portable STD was provided by Mr. McCoy for use as a back-up as well as deployment from the ship's helocopters and/or small boat. This is a new, state-of-the-art instrument manufactured by Applied Micro Systems of Vancouver, B. C. It appears to be an ideal replacement for the 15-year old APL/UW light-weight profiler. McCoy is looking into the development of a battery-operated, motorized portable winch of the APL variety to replace the manually operated winch used on this cruise. Eight STD casts were made with this unit; several casts were made with it strapped to the NBIS CTD for intercomparison. The accuracy of the STD is well within tolerance (Figure 6). However, the vertical resolution should be increased, a feature already incorporated into a more advanced model of this STD.

The two embarked helicopters were used extensively in an ice reconnaisance role. Fourty-five sorties were flown for a total of 71 flight hours. Many additional miles of echo soundings were gained, especially along the Greenland coast, due to helicopter assistance in locating navigable leads in the ice.

III. DISCUSSION

A. *Fram Strait*

The ship departed Reykiavik at 1100 on 19 August 1984 heading westward around Iceland, through the Denmark Straits, then northward to 79°N, 0°W. CTD casts, originally scheduled along this northward transect, were omitted due to heavy seas and extreme ship rolls. Ice was first encountered in the vicinity of 76.5°N, 4°W. NORTHWIND proceeded northward, skirting the ice edge in greatly dampened seas, to 78°40'N where seven CTD lowerings were made along an eastward track at this latitude (Figure 7). These CTD observations were made over the line of current meters installed earlier in the summer by Aagaard as part of the MIZEX 84 project. The line along 78°40'N has repeatedly been sounded throughout the summer by various MIZEX participants. Our eastward line took us within 28 km of the Svalbard coast. This track was mostly in the Atlantic Water layer, the principal component of the West Spitzbergen Current. Within 100 km of the Spitzbergen coast temperatures were in excess of 6°C. Seaward from here to the East Greenland Current near-surface temperatures were above 5°C.

NORTHWIND then returned westward sampling along the 79th parallel until the 3°E meridian was reached in the vicinity of the Molloy Deep. The ship then proceeded NW sampling across the quasi-permanent warm eddy frequently found in this region. It appears our track crossed the southwest quarter of the eddy, first encountering cold water (< 1°C) associated with the southern, ice-covered limb of the gyre (Station 14), then warmer water (> 5°C) associated with the gyre center (Stations 15-18). Figure 8, a temperature-salinity transect through the gyre, shows the cold southern limb has a horizontal temperature gradient of

4°C over a 5 km interval. The diameter across this portion of the warm eddy was approximately 60 km, consistent with previous estimates (Wadhams and Squire, 1983; Smith et al., 1984). The down-bowing of the 0°C isotherm suggests that the eddy extended at least to 900 m depth.

Upon reaching 80°N the ship turned westward to proceed on to the continental shelf. Figure 9 shows a transect along this parallel. The position of the EGPF is readily obvious between Stations 23 and 24 which also coincided with the location of the ice edge. Unlike the situation near 76°-78°N where the lower boundary of the EGPF intersects the continental slope, at 80°N the lower boundary is 100 km seaward of the shelf break. Much finestructure is found in the temperature profiles in the vicinity of the front.

B. *Bathymetry*

The bathymetric sounding program commenced on 26 August upon crossing onto the continental shelf. Perry laid out track lines which initially criss-crossed over the trough extending NW-SE from Ingolfs Fjord, tentatively named the Westwind Trough, crossed over Ob' Bank, thence southward along the Greenland coast and into the fjords along the coast. Soundings over Ob' Bank, along the coast, in Antarctic Bugt, and in Ingolfs Fjord were supplemented by soundings recorded by NORTHWIND's arctic survey boat. Antarctic Bugt could not be sounded to any extent as it was mostly ice covered. An ice shelf with a cliff-like wall approximately 30 m high covered its northern approach.

NORTHWIND proceeded about 24 km into Ingolfs Fjord stopping at 016°47'W at the ice edge which extended across the width of the fjord. This ice was a mixture of one meter thick ice floes of 10-50 m diameter locked into a mastic of new ice about 15 cm thick. Upon entering the fjord a sill was encountered about 15 km into the fjord (at 016°28'W) with a sill depth of 92 m (50 fathoms). CTD casts were made on either side of the sill (Stations 86 and 87). Water properties at all

depths (0-250 m) were identically similar on either side of the sill suggesting that the sill must somewhere be deeper than 92 m to permit the cross-sill exchange of deep water. Six crossings of the sill showed that it deepened from north to south from 73 m to 155 m (40 to 85 fathoms) about three-fourths of the distance across the fjord. Dijmphna Sund, a fjord just south of Ingolfs Fjord, was sounded on 30 August. Station 103 is on top of the sill at 100 m depth. This fjord was ice free at least up to the island which divides the fjord in two.

Upon completion of the fjord surveys, NORTHWIND commenced a series of east-west tracks separated by about 28 km which extended from the coastline, across Belgica Bank and seaward to the shelf break (400-500 fathom contour). A shoal area of less than 15 m (8 fathoms) , tentatively named Northwind Shoal, was found on Belgica Bank. *Due to the presence of shorefast ice* south of 79.5°N, NORTHWIND was only able to penetrate westward to about 015°30'W. Hence, only limited soundings of the trough lying between the coast and Belgica Bank could be made. This trough, tentatively named Norske Trough after the island it is near, has depths of at least 600 m. Its shoreward boundary could not be determined due to inaccessibility by shorefast ice.

The series of cross-shelf soundings also determined the presence of a heretofor unknown trough trending NW-SE about mid-way between Northwind Trough and Belgica Dyb. Because of the similar character of these three troughs, especially their trend over the continental shelf, it is suspected that they are of tectonic origin and are not a product of glacial erosion. In addition, other deep depressions were found on Belgica Bank. CTD soundings showed these depressions to contain water of similar character to that found in the troughs.

C. *Belgica Dyb*

A series of four crossings of Belgica Dyb assisted in better defining the shape and boundary of this major trough. Figure

10 illustrates the temperature-salinity properties of the waters mid-way along the length of the trough while Figure 11 illustrates water properties along the Dyb axis. There is a general deepening of isolines westward. The wave-like nature of these isolines, also observed in transverse sections from the 1979 and 1981 data, may simply reflect cross-channel variability since the stations were not necessarily on the axis of the Dyb.

One sees in the Polar Water (PW) fraction (temperatures <0°C) a thin lens of relatively warm, low-salinity water (>-1°C, 31) centered near 25 m depth which thickens and shoals as it approaches the coast. This lens is a remnant of summer heating/freshening. Earlier in the summer the waters above this lens were likely as warm but have now cooled with the onset of fall. Beneath this lens is a band of cold water (>-1.7°C) approximately 25 m thick. This water, almost at the freezing point and nearly isothermal and isohaline, is proposed by Newton (1984), based upon salt deficit considerations, to be a remnant of freezing conditions during a previous winter. Most of this cold water lies between the 32.1 and 32.5 isohalines. Newton and Piper (1981) describe a similar low-temperature lens found over the East Greenland continental shelf in September 1979 but in the salinity range 33.0 to 33.3. This salinity difference is most likely due to a greater freezing stress throughout the winter preceeding the 1979 observations. An indirect measure of a less intense winter in 1983-1984 might be the extreme lack of ice cover experienced during the AE84 cruise.

Beneath the PW lies the relatively warm and salty (>34.9) Atlantic Intermediate Water (AIW) delineated by positive temperatures. This water is found generally below 150 m and constitutes about 50% of the water in the Dyb. Warm water in excess of 1°C is present throughout the length of the trough, at least through Station 185 where Belgica Dyb merges into Norske Trough (Figure 12). It is present for at least 80 km in the southern reaches of Norske Trough. Its northern extent could not be determined past Station 182 due to the presence of fast

ice over the trough which made CTD observations impossible. Many stations on the shallow shelf, especially those near the troughs, also had bottom waters with temperatures above 0°C. In contrast to its vast extent in 1984, in 1979 AIW of at least 1°C was found only about mid-way up Belgica Dyb, ceasing at about the location of the present Station 245. This heat far back on the shelf in 1984 may have assisted in removing much of the normally present ice cover.

Another transect down the axis of Belgica Dyb was made 2.5 days after that shown in Figure 11. Of interest here is the existence of a possible surge in the flow. The 2°C isotherm (Figure 13) indicates warm water has migrated shoreward on to the continental shelf during this 2.5 day interval. Also the frontal boundary between 50 and 100 m depth has moved seaward approximately 40 km steepening the gradient considerably. waters and inflow at depth. The change in isotherm/isohaline patterns indicates this flow may be dominated by pulse-like motions, much like those observed in Barrow Canyon (Mountain, 1974). Data are not available at this time to confirm the source of the surge but response to atmospheric pressure changes or a relaxation of the geostrophic flow are possible causes.

D. Westwind Trough.

Westwind Trough is oriented approximately parallel to Belgica Dyb but located 360 km farther north. Its axial depth is generally about 300 m, 100 m shallower than Belgica Dyb. Figure 14 is a transverse section of those stations near the center of the trough. Station 32 is located over the shelf break. Note that at this latitude (80°N) the EGPF is displaced about 100 km seaward of the shelf break (Figure 9). Hence, little residual warmth from the Return Atlantic Current is observed in the deeper waters of the trough. Near-bottom waters are cooler and fresher (T=0° to 0.5°C; S=34.8) than their counterparts in Belgica Dyb. This may in part be due to the shallower depth of Westwind Trough but a vertical section from the seaward end of the trough (Figure 9) suggests it may be

more due to the seaward displacement of the EGPF at latitudes above 78°N and consequent removal of a near-by source of water with temperatures in excess of 2°C.

The upper PW layer is also slightly different than the PW layer of Belgica Dyb. The depths of the -1.5°C isotherms are nearly the same; however, the volume of -1.7°C water is significantly greater in Westwind Trough. This near-freezing water occupies a narrow salinity (density) band between 32.1 and 32.3 and is most likely of similar origin to that in Belgica Dyb, i. e., thought to be a remnant of the previous winter's freezing over the shallow banks on the shelf. The increased volume of near freezing water in Westwind Trough is probably due to reduced heating from below, i. e., the absence of 1°C or warmer water so plentiful in Belgica Dyb. Surface conditions over both troughs were quite similar in temperature and degree of ice cover ruling out increased heating from above.

E. East Greenland Polar Front

A total of 17 crossings of the shelf break and the EGPF were made extending from 80°N to 75°30'N. Only the transect along 80°N shows the front seaward of the continental slope (Figure 9). From 79°N southward the lower part of the EGPF was coincident with the continental slope while its upper boundary, as delineated by the 0°C isotherm, was generally 10 to 40 km farther eastward (Figure 15). The frontal gradient was steeper this year compared to 1981 when observations were made in October-November at the onset of the cooling season. In 1984 the isopleths were more nearly vertical with maximum values ranging from 6°C in 2 km to 5°C in 5 km.

From 77°30'N northward the EGPF was separated into two layers: an upper-layer front generally seaward of the ice edge and displaced approximately 40 km east of the lower-layer front (see for example Figure 16). The upper-layer front extends from the surface to about 25 m in depth. In the transects south of 77°30'N (Figure 11) the upper layer is weak or absent.

A possible explanation for the formation of the upper layer to the north is the occurrence of more extensive summertime melting and dilution of the ice by the warm (4° to 5°C) AW. Further to the south the AW cools with only slight dilution thus forming AIW with maximum temperatures of 2.5° to 3°C. Hence, the near-surface lens of cool dilute water is gradually diminished with decreasing latitude until it virtually vanishes south of 77°N (Figure 17).

The transect along 78°54'N showed the presence of a cold eddy in the process of being pinched off from its PW source (Figure 18). Eddies having temperatures of less than -1°C have occasionally been reported in this region between 78° and 79°N (Aagaard and Coachman, 1968; Newton and Piper, 1981; Paquette et al., in press). It has generally been accepted that these eddies are derived from the PW west of the EGPF. The isotherms and isohalines of Figure 18 show that indeed this may be the case. The cold core is comprised of PW from about 50 m depth having temperatures >-1.5°C and salinities between 34.1 and 34.3, quite similar to the values reported by Newton and Piper (1981). It has a radius of about 15 km, similar to the baroclinic Rossby radius of deformation of mesoscale eddies for this latitude. Of the 17 crossings of the EGPF during this cruise, this is the only one in which a cold eddy was observed on the warm side of the front. Because the density field at these cold temperatures is dependent mainly on the salinity distribution, the baroclinic shear determined from dynamic height calculations indicates this eddy would rotate anticyclonically. A crossing to the north of this transect (along 78°10'N, not shown) only indicates moderate cooling (0.5°C) at the depth of the cold core; hence, the north-south radius of the eddy must be <30 km.

F. Return Atlantic Current

The warm AW of the West Spitzbergen Current (WSC) has long been known to branch westward and join with the EGC. This southward flowing warm water is termed the Return Atlantic

Current (RAC). Earlier depictions, such as seen in Kiilerich (1945), Dietrich (1963), and Aagaard and Coachman (1968) indicate the westward turning to take place from 75° to perhaps 80°N. The northern extent of the westward turning is uncertain and has been the subject of some speculation (Paquette et al., in press).

Two crossings, one along 78°40'N (Figure 7) extending from the prime meridian to the Spitzbergen coast, the other along 79°N (Figure 19) shed some light on this subject. In Figure 7 one sees the warm (>6°C) core of the WSC as a wedge pinched between the dome of the Greenland Sea gyre (uptilted isotherms and isohalines) and the coast. A thin (60 m) veneer of warm surface water (>4°C) overlies the dome of colder Greenland Sea water. In Figure 19 similar features are observed but the warm water lens is much thicker depressing the 2°, 1°, 0°C, and 35 ppt isopleths by more than 200 m. Evidently the volume of AW flowing westwardalong 79°N is greater than that some 30 km to the south. Presumably the ice edge across Fram Strait (80°N) is melted back by the warm AW and the location of the ice edge delineates the northern boundary of the westward flowing AW.

That most of the westward turning, at least during late summer 1984, took place at higher latitudes than previously reported is also substantiated by examining the temperatures in the core of the RAC from cross-sections between 79°N and 75°N. The maximum temperature of the AW core at 78°48'N, where the northern portion of the front initially becomes coincident with the continental slope (Figure 15), ranges between 5.6° and 5.8°C. In contrast, at 75°30'N the maximum core temperature has cooled to just slightly more than 3°C (Figure 20). This cooling of the AW core water with decreasing latitude may be due to atmospheric cooling and subsequent sinking or possible mixing along the frontal boundary. However, one might expect that the temperature of AW would increase with decreasing latitude if it were being continuously fed by warm westward flowing WSC water which at 75° to 76°N might be expected to have a maximum

temperature of 10°C or more. The frontal crossings between 75° and 80°N suggest that such is not the case and further suggest that in 1984 most of the westward turning took place at latitudes above 78°N.

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TABLE 1. CTD Stations During AE84

STATION NUMBER	LATITUDE	LONGTITUDE	DEPTH
1	N76 33.6	W003 33.3	2934
2	N76 53.1	W003 14.8	1930
3	N78 39.8	W000 06.3	1058
4	N78 40.0	E002 02.4	2502
5	N78 40.5	E003 57.3	2294
6	N78 33.6	E005 24.3	2349
7	N78 40.6	E006 23.2	1934
8	N78 40.7	E008 07.5	959
9	N78 40.9	E009 21.3	457
10	N78 59.5	E009 07.9	208
11	N78 59.6	E006 52.7	1288
12	N78 59.8	E004 50.0	2408
13	N78 59.2	E002 35.8	2367
14	N79 07.9	E002 10.5	4031
15	N79 11.9	E002 18.3	4031
16	N79 15.2	E002 07.4	3757
17	N79 22.9	E001 53.8	3025
18	N79 31.3	E001 24.9	3080
19	N79 43.9	E001 09.3	2477
20	N79 47.0	E000 51.8	2294
21	N79 56.1	E000 34.6	2586
22	N79 55.1	W000 02.0	3482
23	N79 53.2	W000 31.2	2751
24	N79 54.6	W001 07.5	2751
25	N79 55.0	W001 37.8	2769
26	N79 56.2	W002 09.0	2751
27	N79 55.7	W002 19.3	2714
28	N79 59.7	W002 50.8	2569
29	N79 58.1	W003 31.2	2294
30	N79 59.6	W004 12.2	1928
31	N79 59.8	W005 07.1	1105
32	N79 53.8	W006 14.1	328
33	N79 57.6	W007 06.0	297
34	N80 02.8	W007 57.9	249
35	N80 13.3	W009 23.0	271
36	N80 20.2	W009 36.6	277
37	N80 15.2	W009 26.9	310
38	N80 11.0	W010 13.5	215
39	N80 17.0	W010 17.2	321
40	N80 20.3	W010 01.4	297
41	N80 32.0	W010 33.9	261
42	N80 38.5	W009 51.9	244
43	N80 36.0	W010 39.9	299
44	N80 33.6	W011 05.9	255
45	N80 31.3	W011 37.4	271
46	N80 26.3	W012 03.9	264
47	N80 24.2	W011 35.9	226
48	N80 44.9	W010 41.0	41
49	N80 43.9	W010 26.7	273
50	N80 54.1	W009 40.7	50
51	N80 53.1	W009 10.6	67
52	N80 54.0	W008 31.5	153
53	N81 01.6	W007 50.7	575
54	N81 02.2	W008 37.9	147
55	N81 01.2	W009 26.7	74
56	N81 03.2	W010 10.7	54
57	N80 55.9	W010 37.8	91
58	N80 52.0	W011 01.6	233
59	N80 46.7	W011 24.0	189
60	N80 52.4	W012 07.0	75
61	N80 56.1	W011 33.3	139
62	N81 00.2	W010 56.8	52
63	N81 05.7	W011 03.3	67
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318	N76 00.1	W008 52.8	1270
319	N75 59.9	W009 07.4	1135
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321	N75 59.5	W009 29.1	367
322	N75 59.8	W009 50.5	487
323	N76 00.0	W010 12.0	295
324	N75 59.7	W010 51.2	300
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327	N75 47.6	W011 39.2	361
328	N75 44.1	W010 56.4	564
329	N75 34.9	W010 42.8	949
330	N75 36.2	W010 31.6	1330
331	N75 32.7	W010 18.3	1727
332	N75 27.4	W010 00.1	2203
333	N75 23.6	W009 47.6	2659

Figure 1. NOAA-7 satellite visual band, 27 August 1984, showing limited ice cover off the east coast of Greenland.

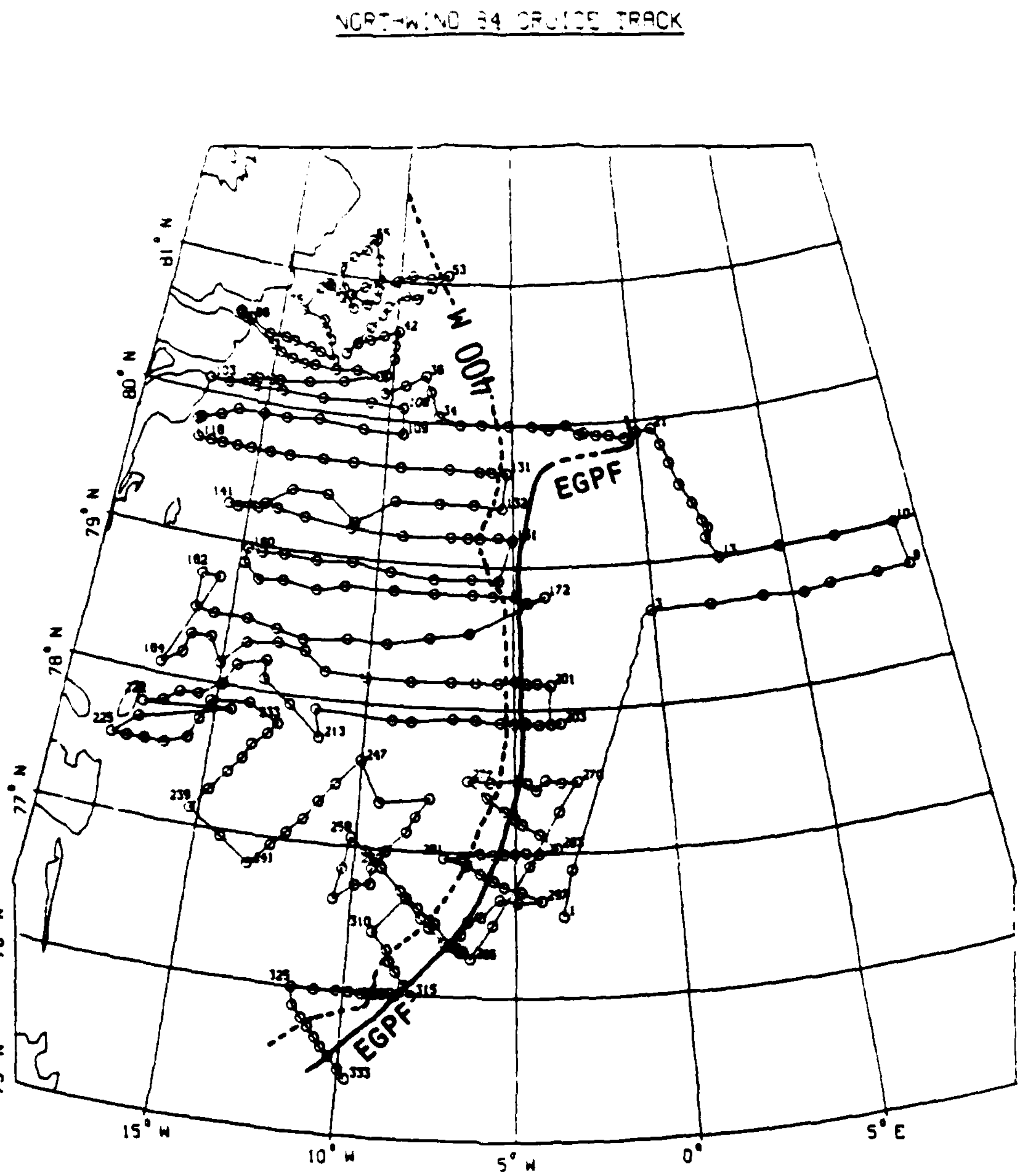

Figure 2. Cruise track and location of CTD stations during the AE84 cruise of August-September 1984. The position of the East Greenland Polar Front and the continental shelf break (400 m isobath) are also shown.

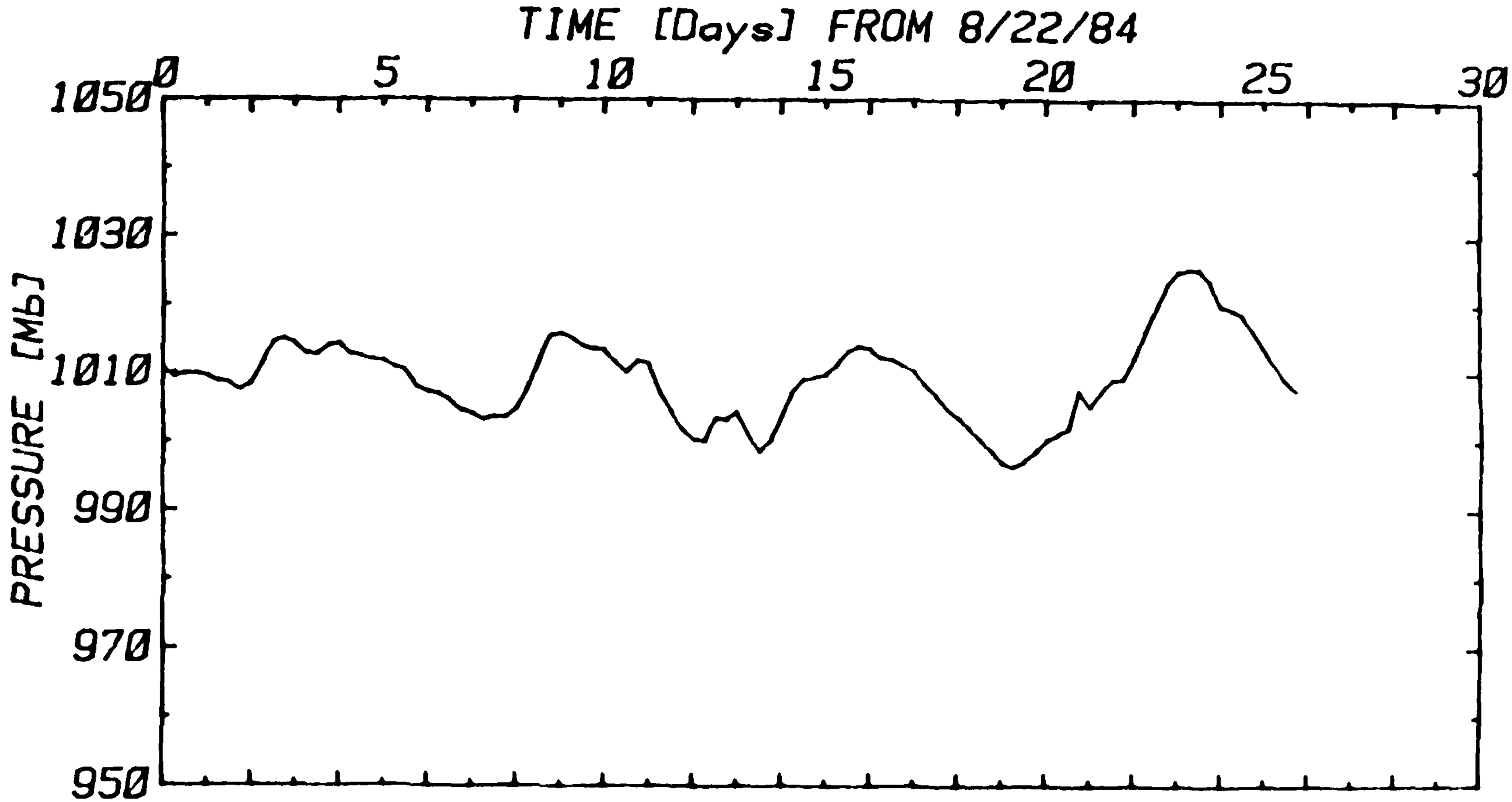

Figure 3. Atmospheric pressure measured every 6 hours commencing 22 August 1984.

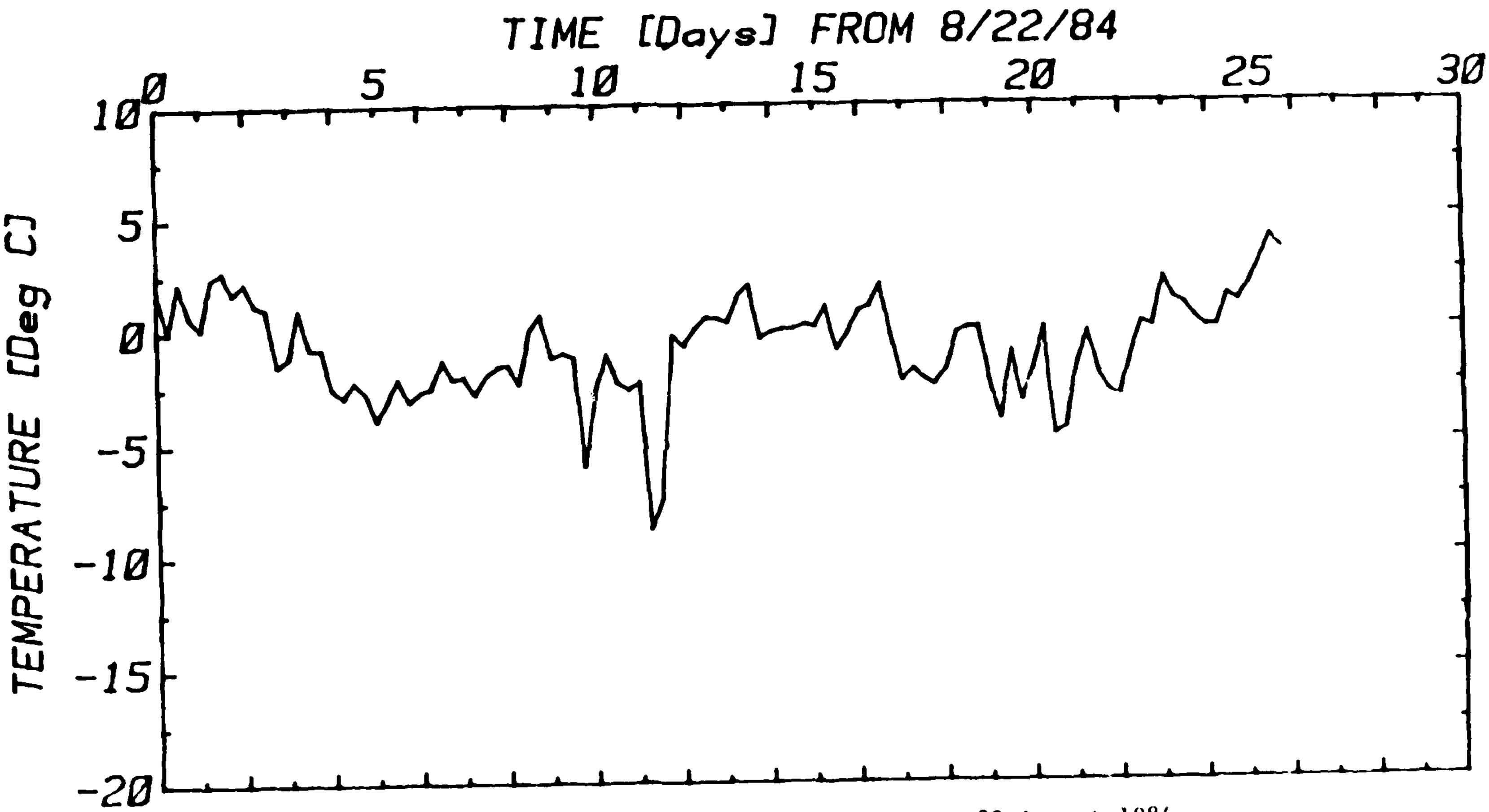

Figure 4. Air temperature measured every 6 hours commencing 22 August 1984.

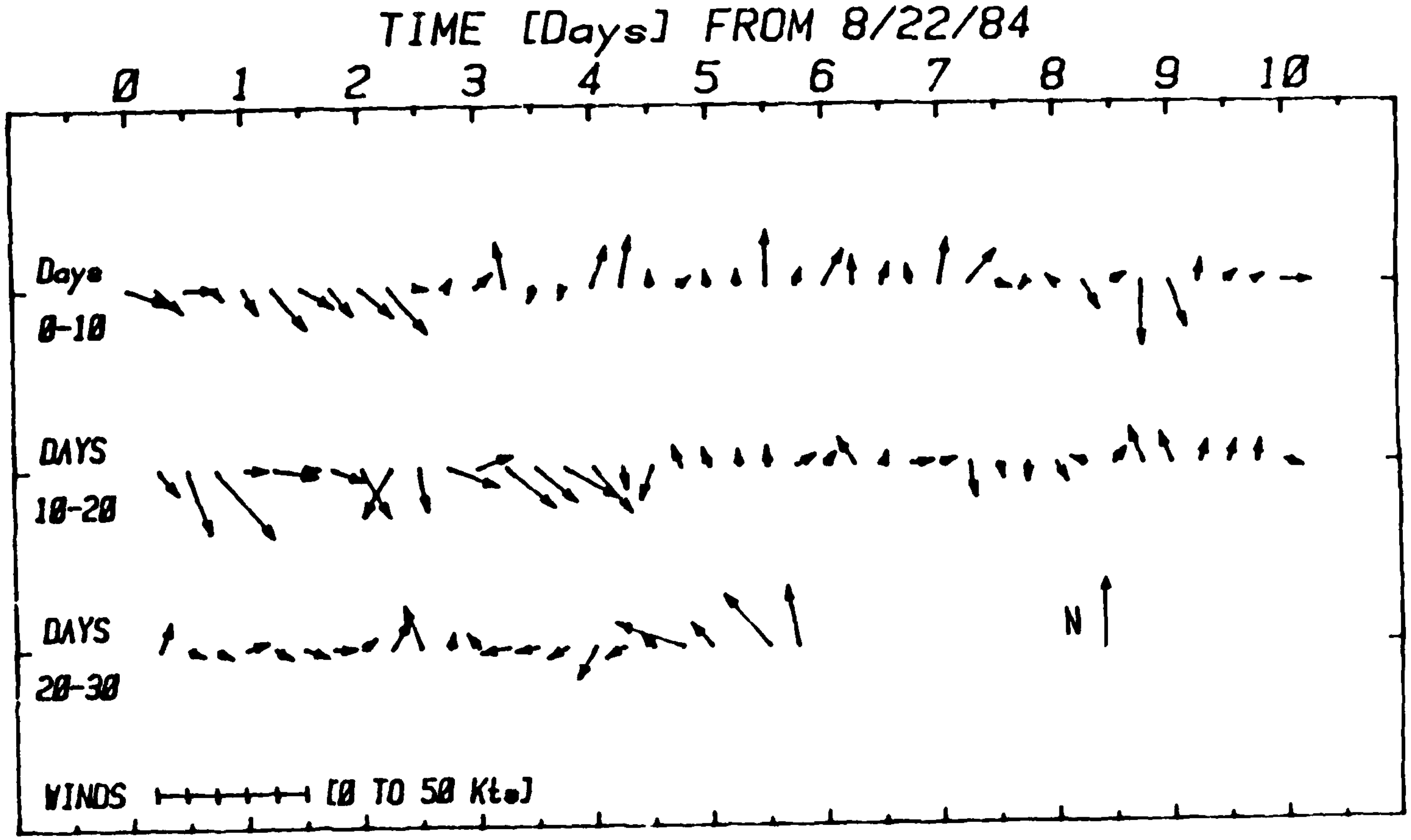

Figure 5. Wind speed and direction measured every 6 hours commencing 22 August 1984.

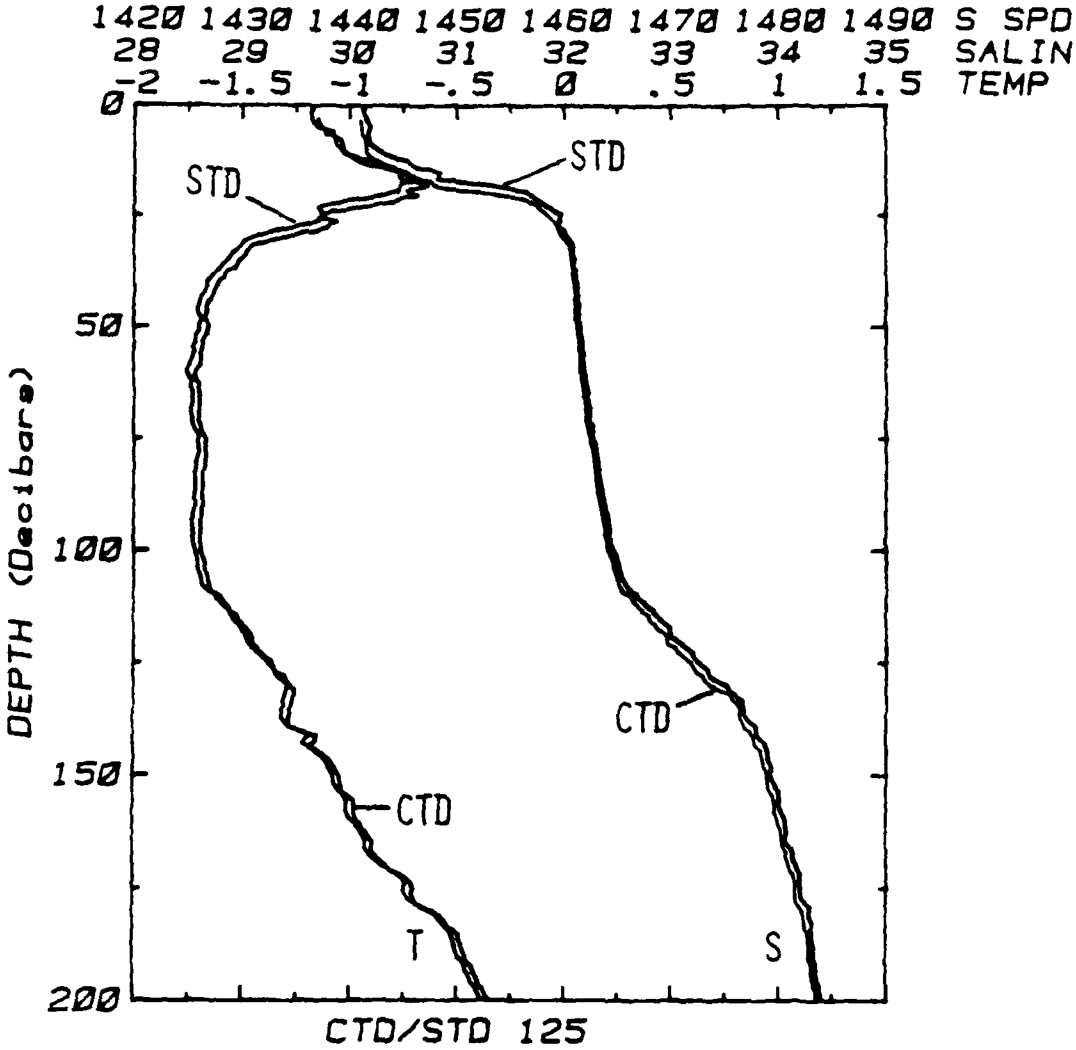

Figure 6. Vertical profiles of temperature and salinity at Station 125 as measured by the NBIS CTD and the Applied Micro Systems STD.

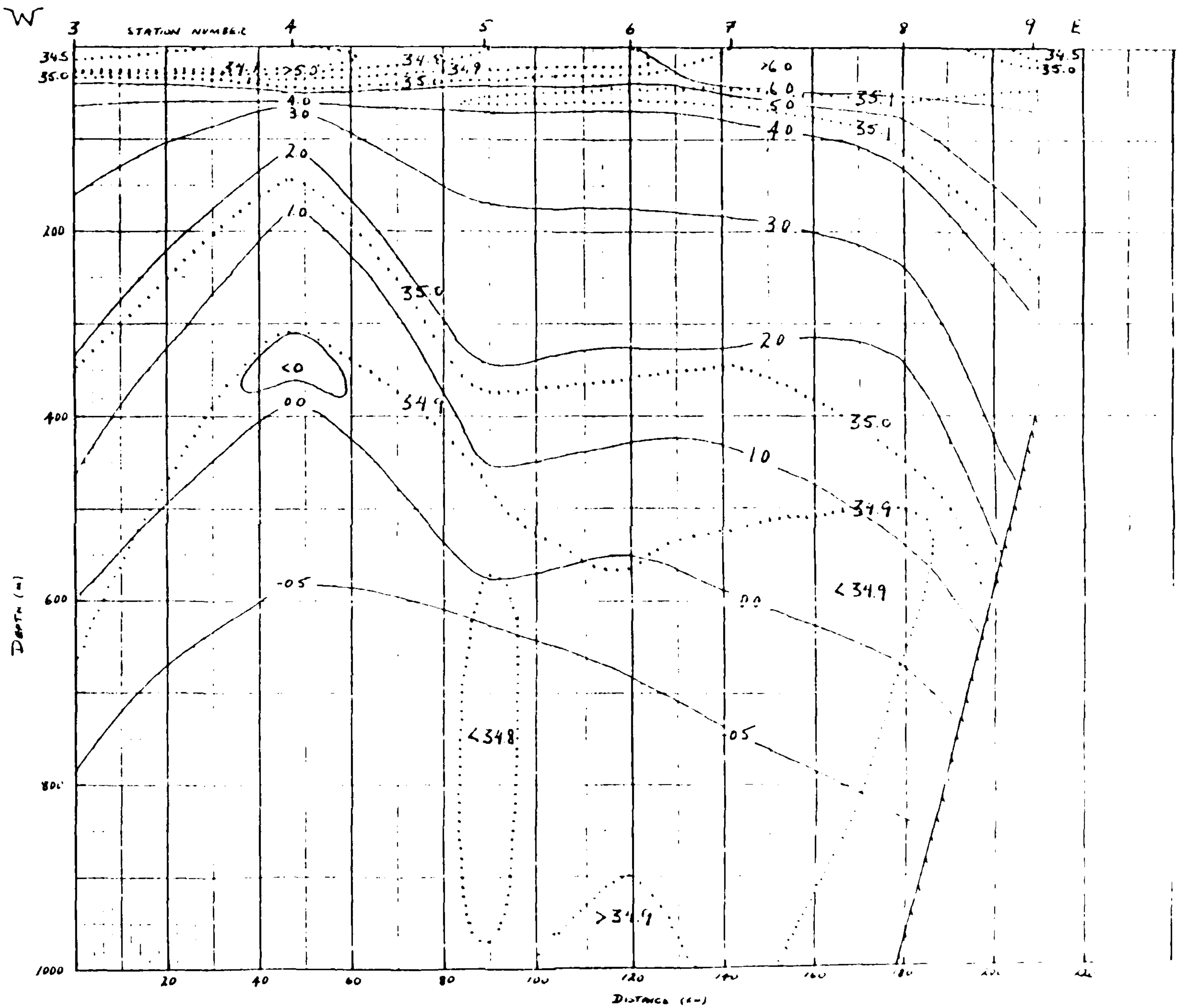

Figure 7. Temperature-salinity cross section along 78° 40'N. Temperature is solid line, salinity is dotted.

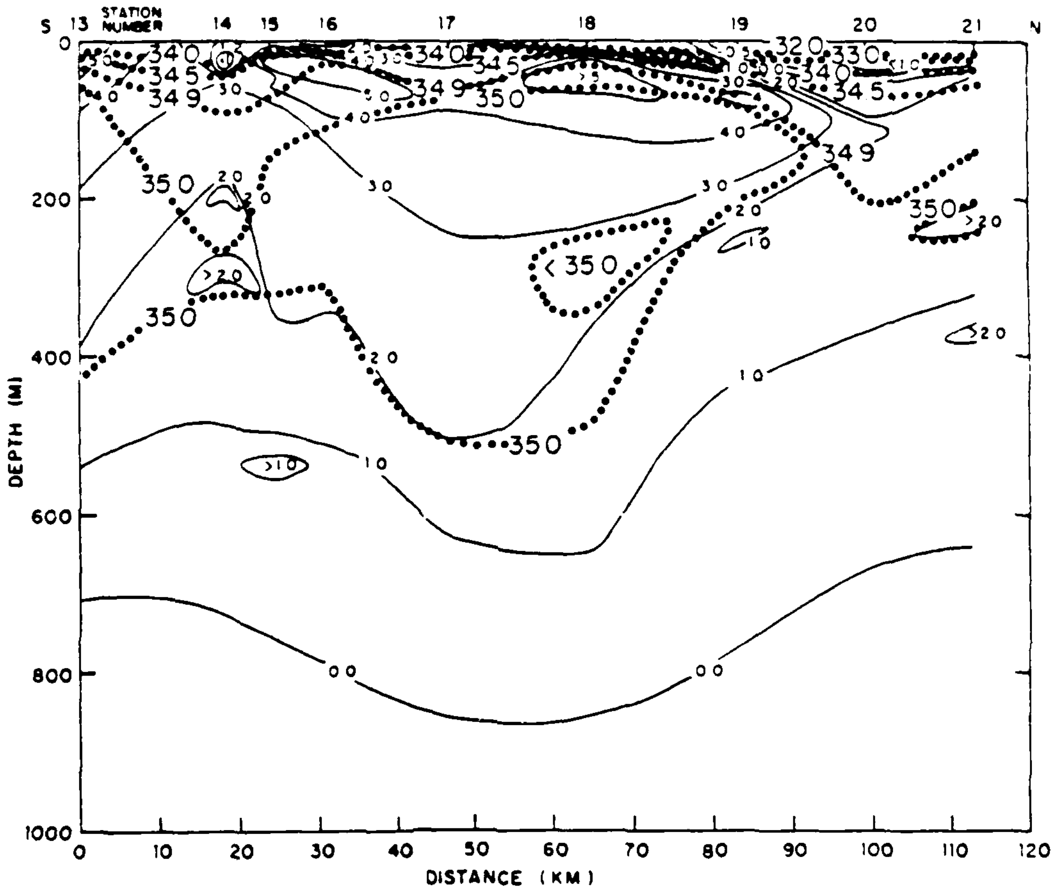

Figure 8. Temperature-salinity cross section across the Molloy Deep eddy.

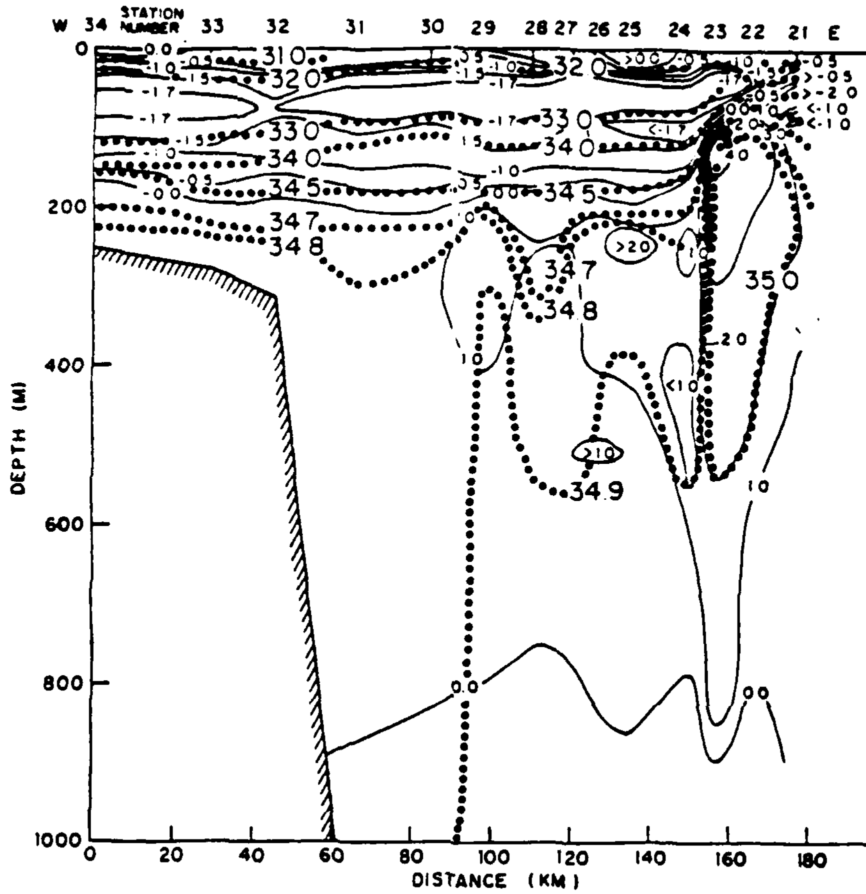

Figure 9. Temperature-salinity cross section along 80°N. The EGPF is 100 km seaward of the continental shelf break.

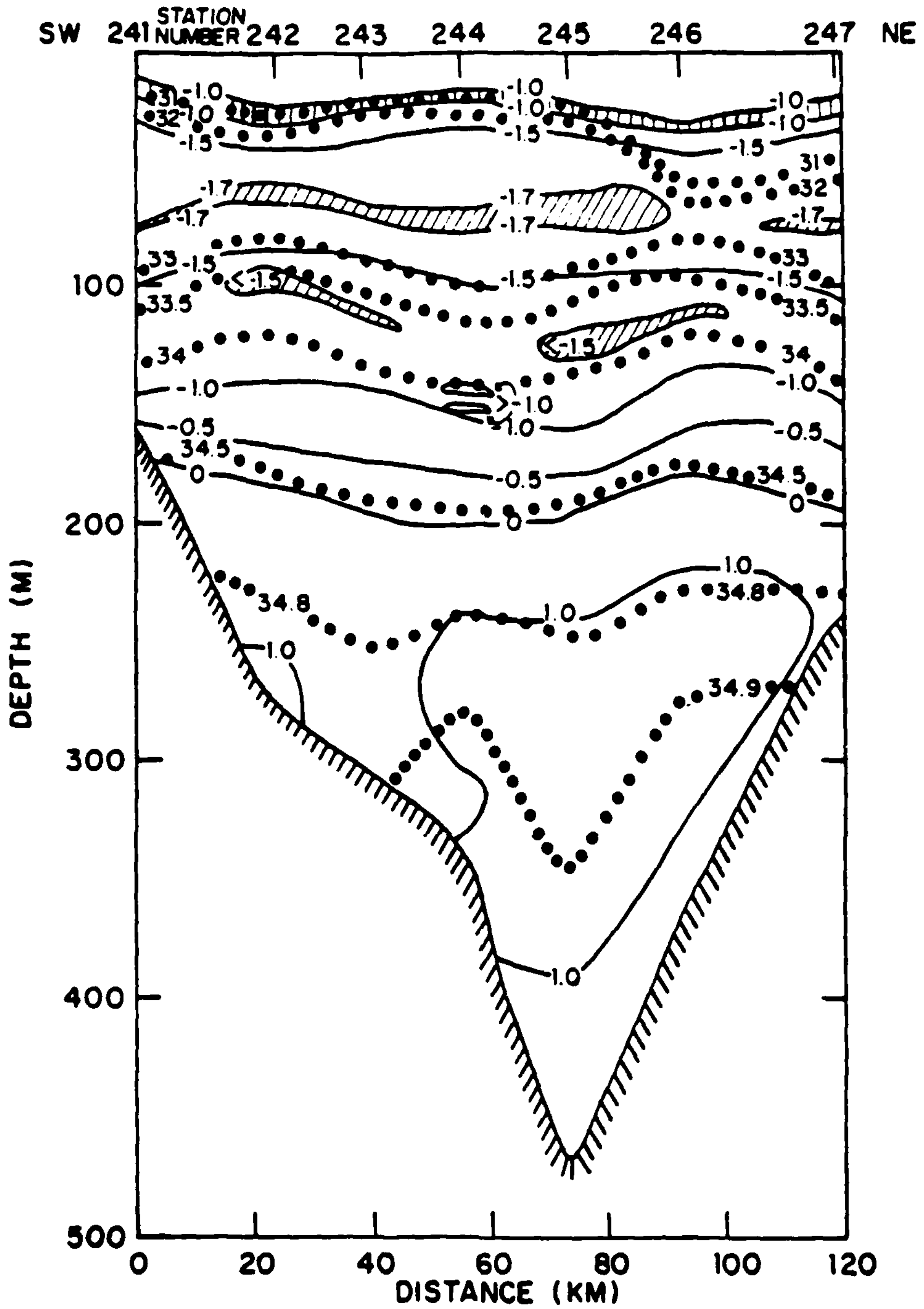

Figure 10. Temperature-salinity cross section mid-way along the length of Belgica Dyb.

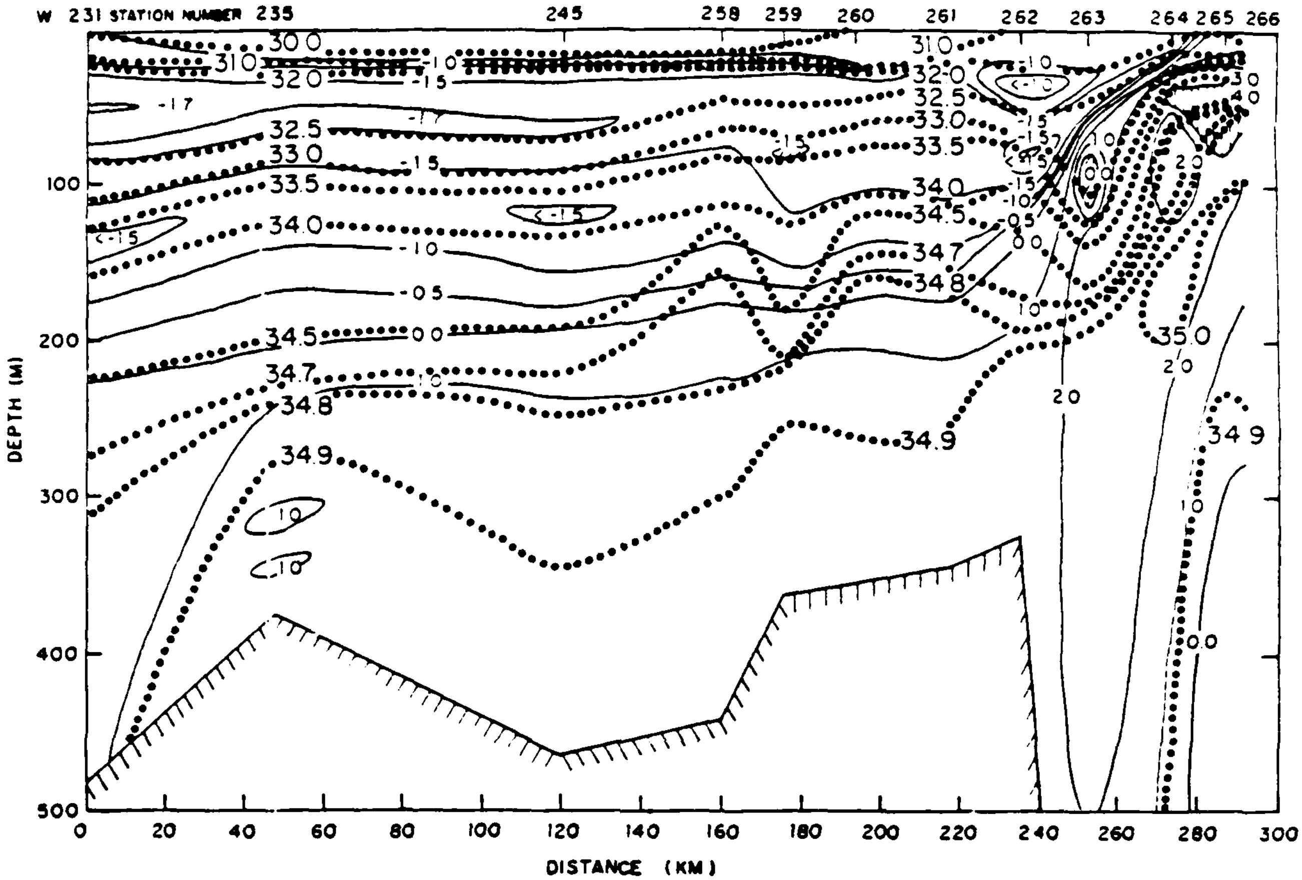

Figure 11. Temperature-salinity cross section along the axis of Belgica Dyb.

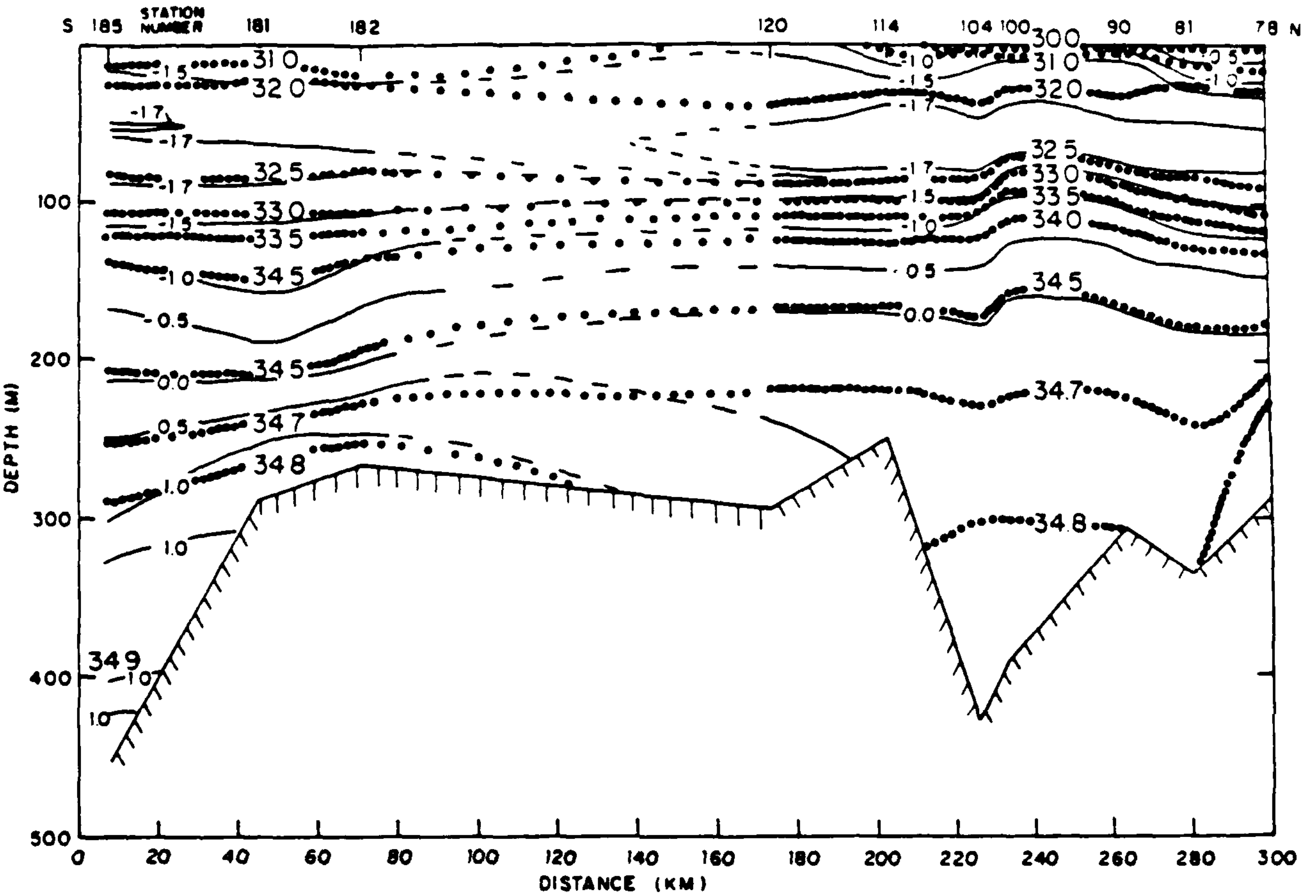

Figure 12. Temperature-salinity cross section along the axis of Norsk Trough.

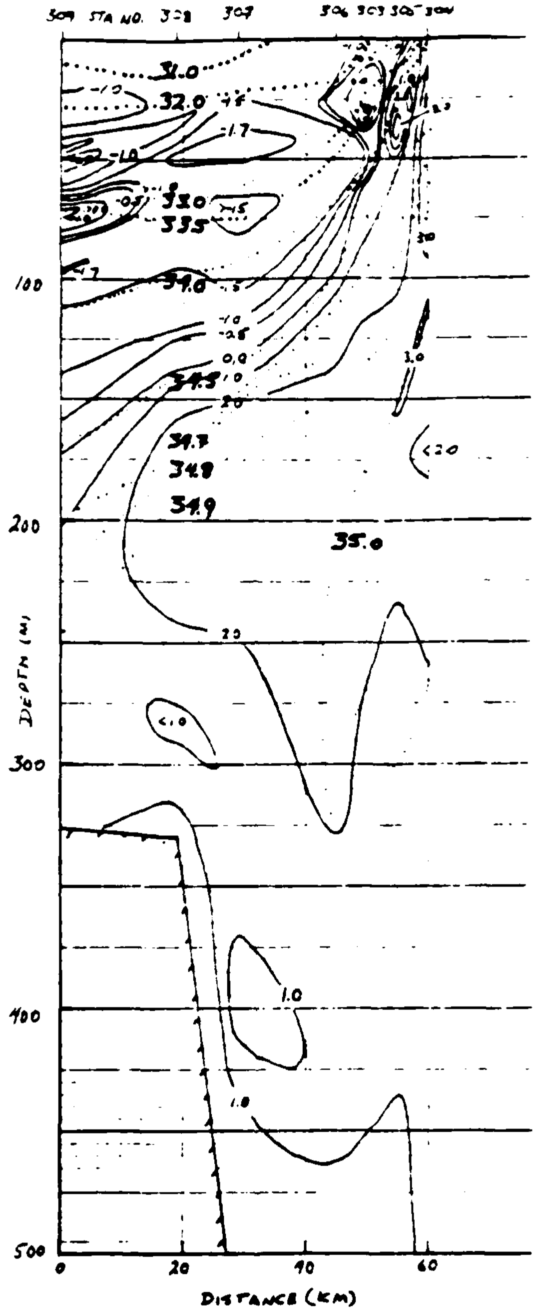

Figure 13. Temperature-salinity cross section along the axis of Belgica Dyb made 2.5 days later than the crossing in Figure 11.

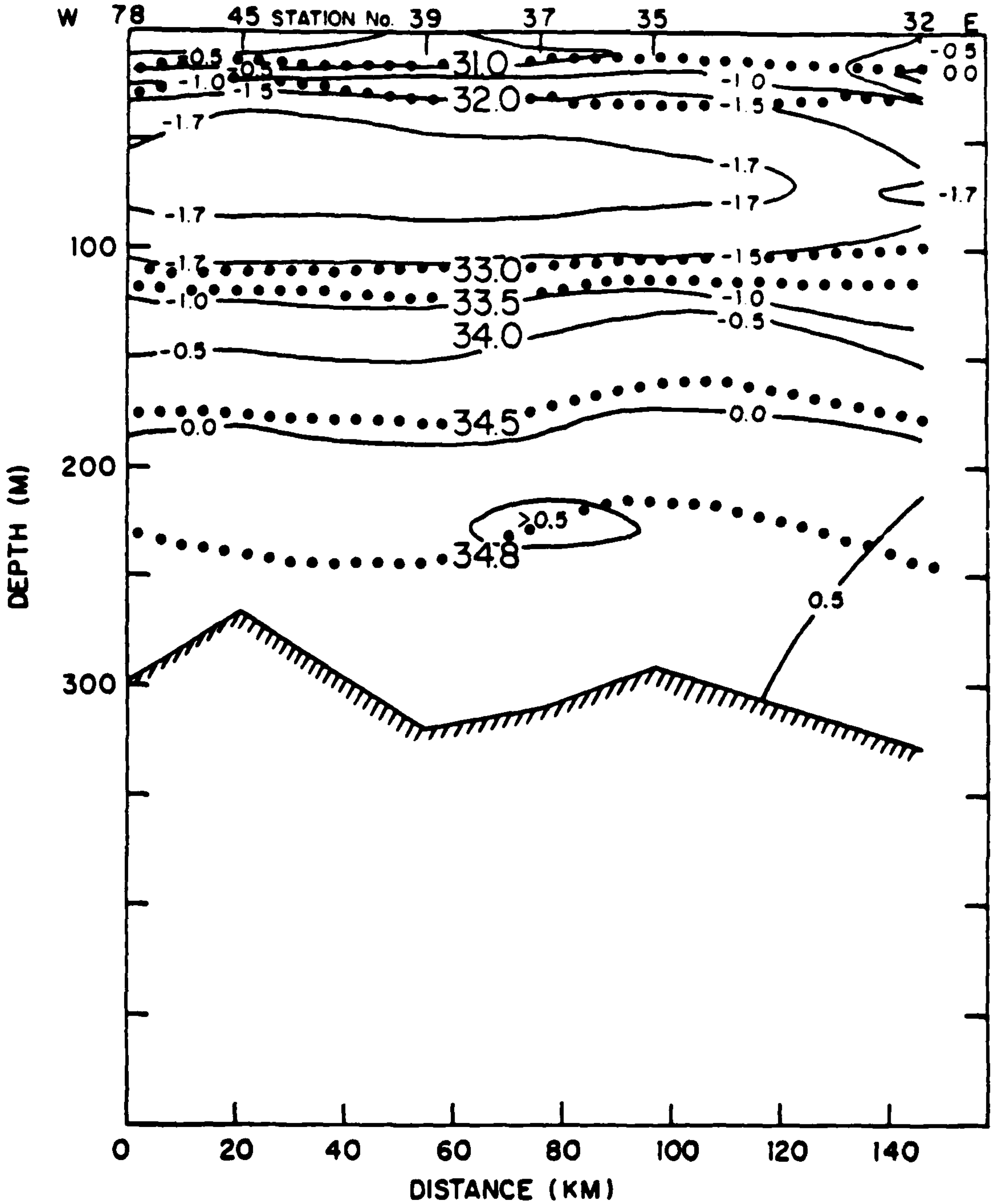

Figure 14. Temperature-salinity cross section along the axis of Westwind Trough.

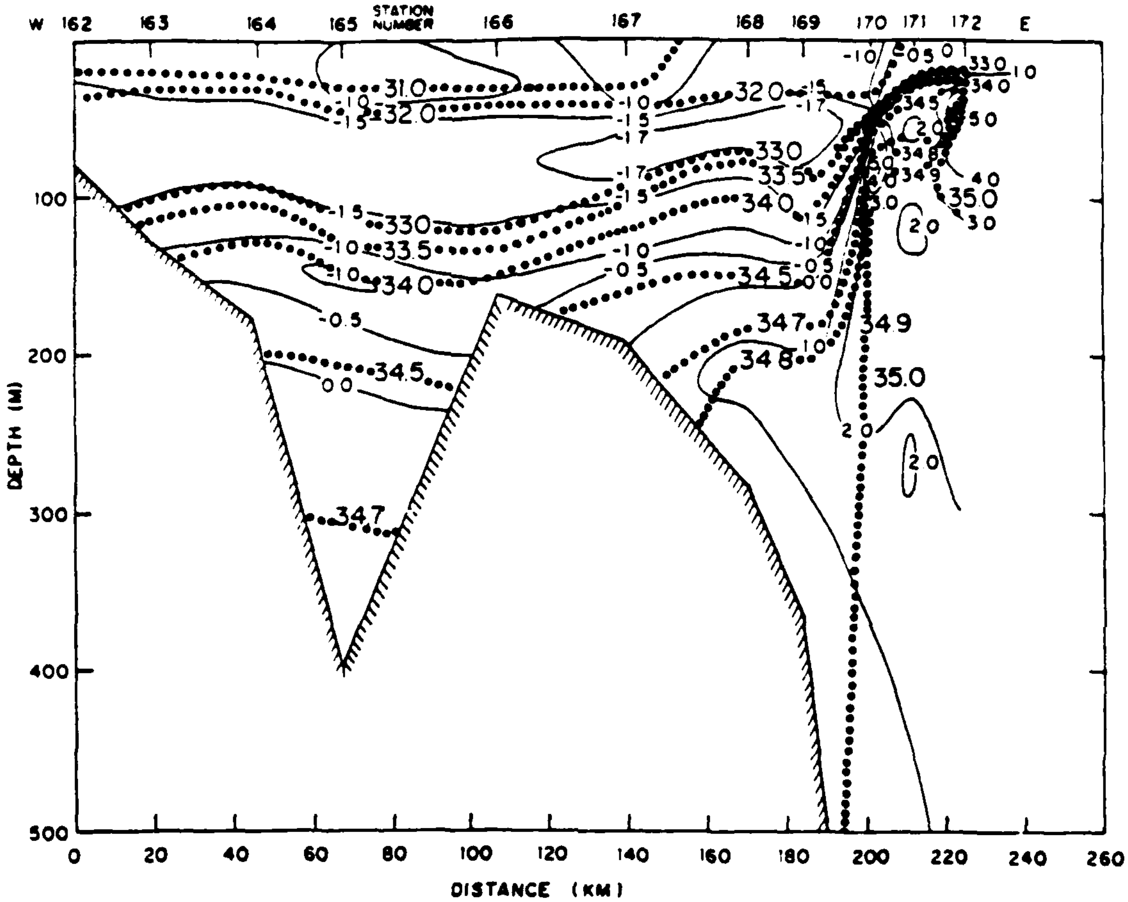

Figure 15. Temperature-salinity cross section along 78° 48'N. The EGPF is positioned over the continental slope in this and all crossings south to at least 75°N.

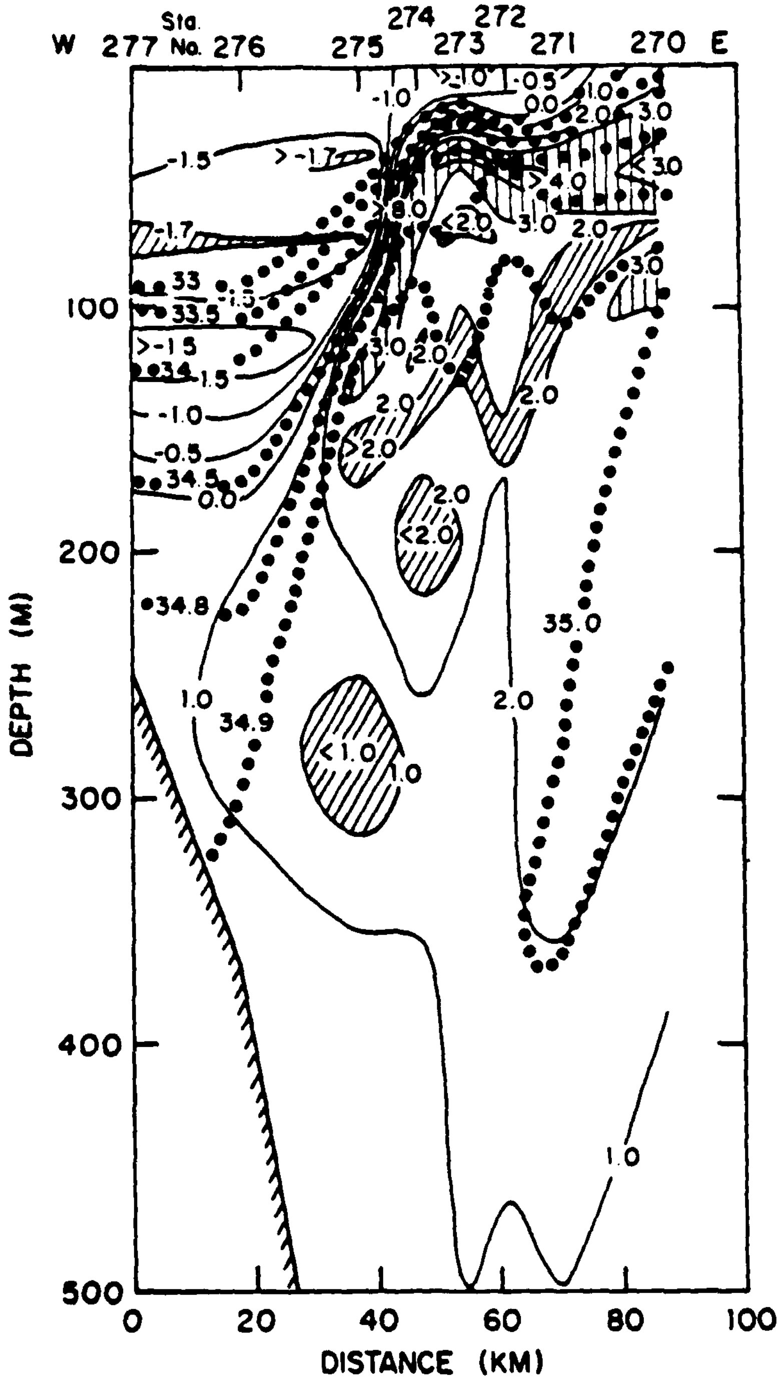

Figure 16. Temperature-salinity cross section along 77° 30'N. Note the EGPF is separated into an upper and a lower layer front.

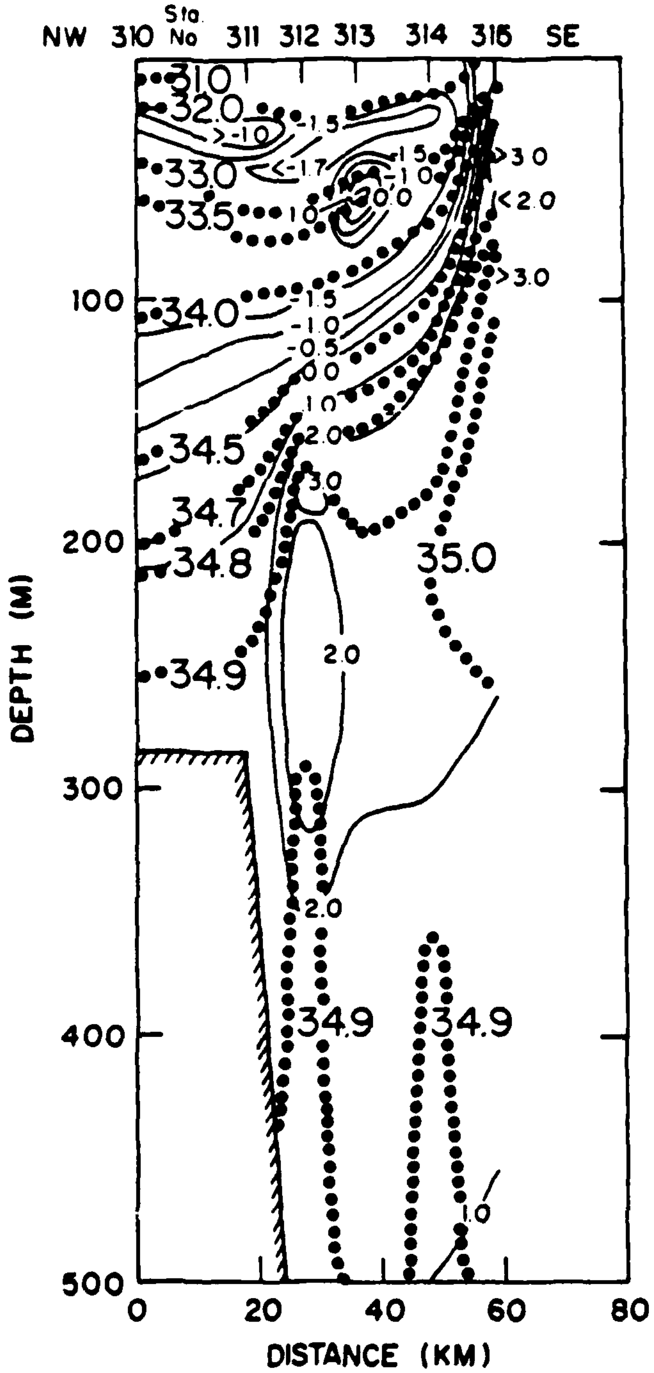

Figure 17. Temperature-salinity cross section along 77°N. The front is comprised of a single layer in this and all transects to the south.

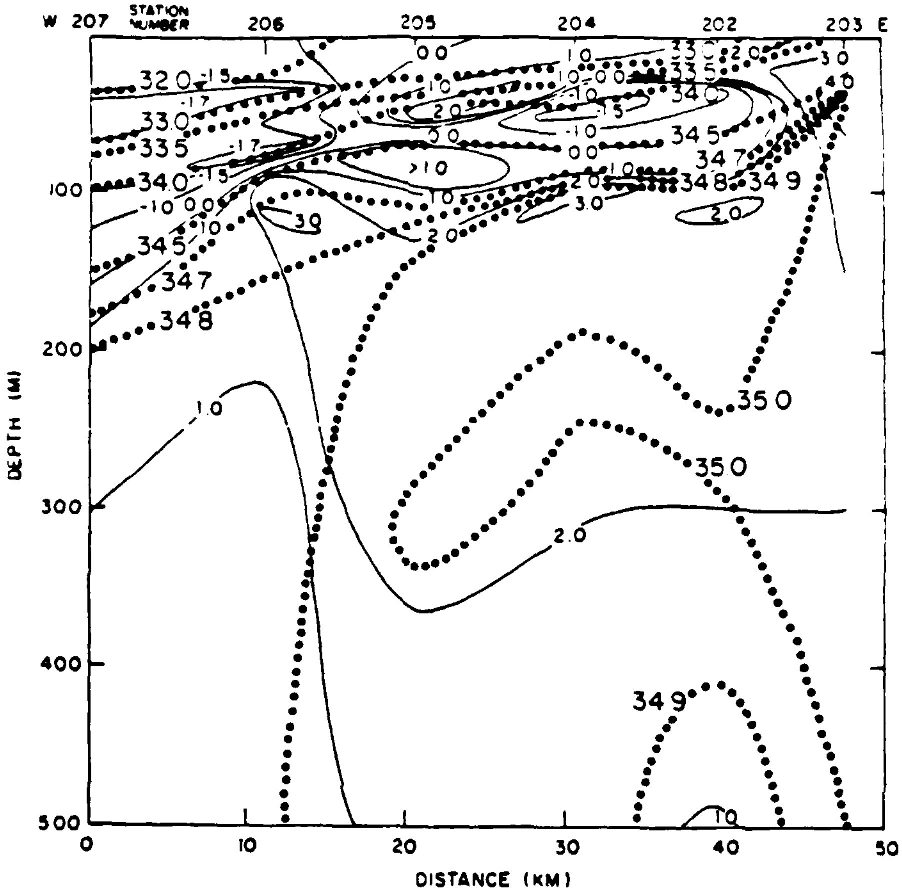

Figure 18. Temperature-salinity cross section along 78° 54'N showing a cold eddy in the process of being pinched off from the EGPF.

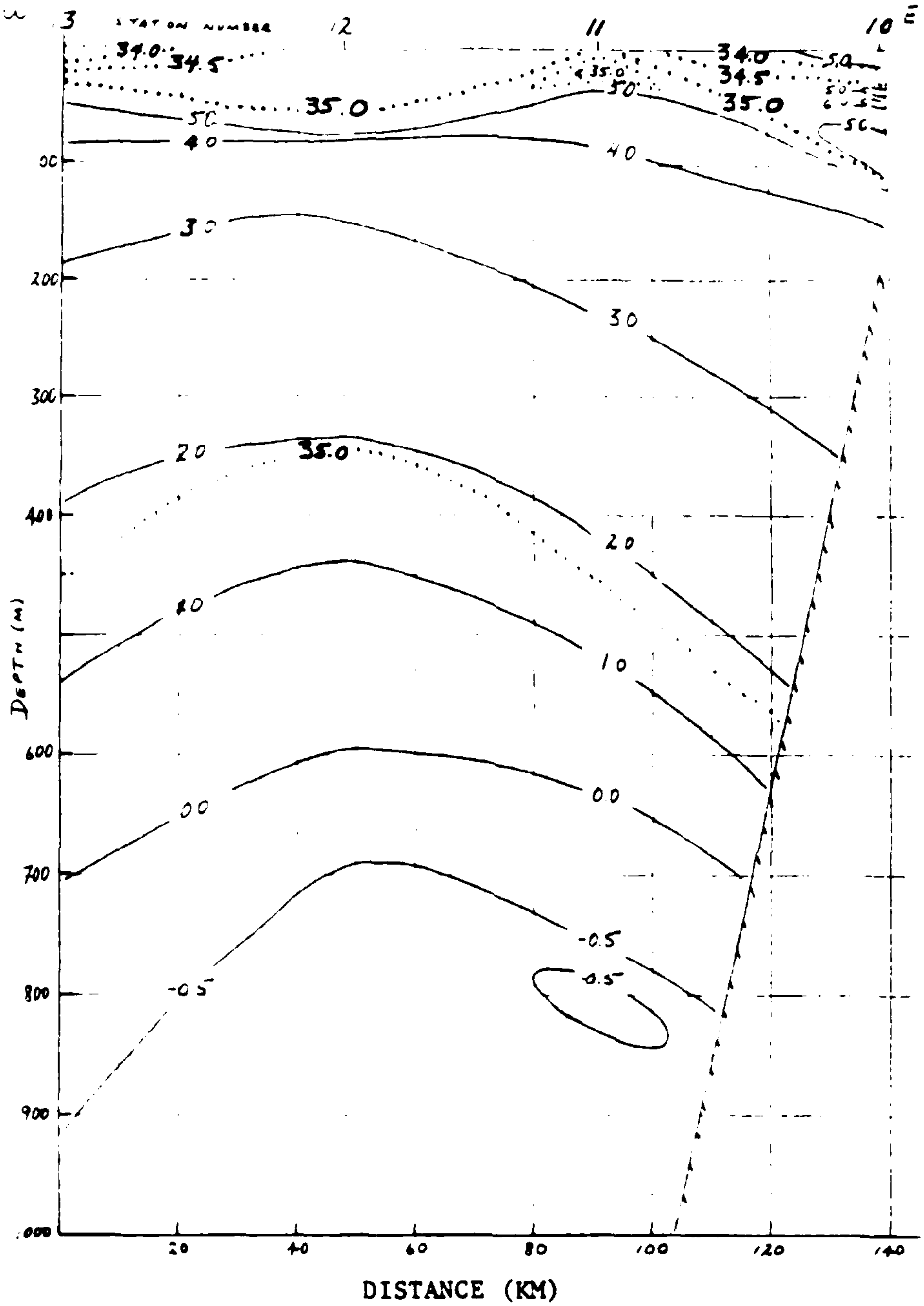

Figure 19. Temperature-salinity cross section along 79°N showing the increased volume of warm Atlantic Water compared to Figure 17.

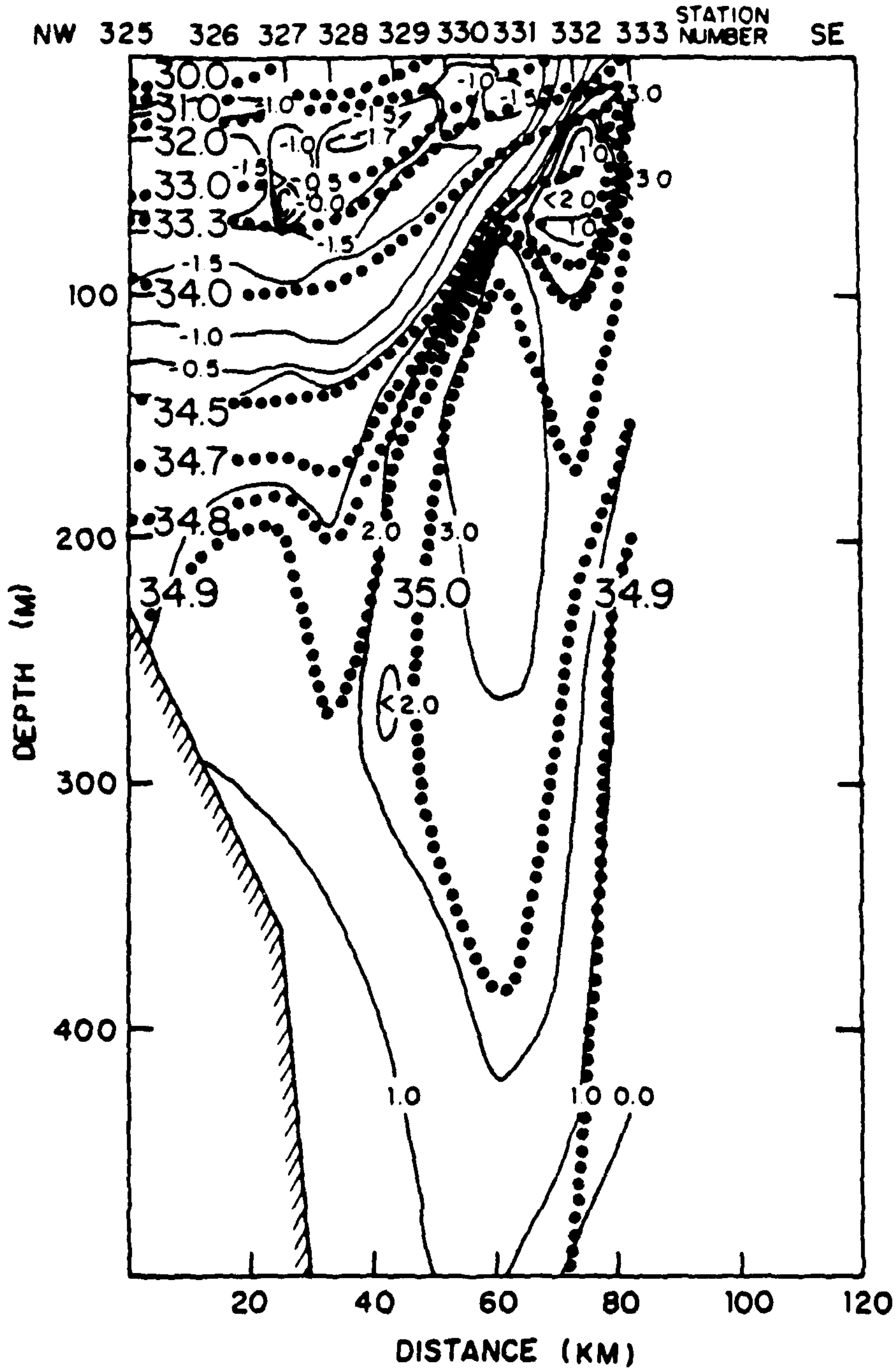

Figure 20. Temperature-salinity cross section along 75° 30' to 76°N. The maximum temperature of the Return Atlantic Current has cooled to 3°C. Compare with Figure 15 where the maximum temperature is 5.6° to 5.8°C.

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